Applications are invited for a PhD studentship for the following project:

Resistive switching in single- and few-layer 2D materials

The position will be based with the ASIN group in the School of Chemistry, Trinity College Dublin and will be co-supervised by Dr. Niall McEvoy and Prof. Paul Hurley. The project will be part of the Materials for ICT platform within the Advanced Materials and Bioengineering Research Centre (AMBER) centre.

Summary of project

The integration of logic and memory elements above standard interconnected circuits is an important research area both for adding functionality to existing chip designs and for developing new device architectures and concepts. 2D materials, such as transition metal dichalcogenides (TMDs), have been heavily studied in recent years due to their outstanding (and tuneable) electrical, optical and mechanical properties. Such 2D systems offer the potential for improved endurance in resistive switching applications compared to conventionally-used amorphous oxides. Certain TMDs, notably transition metal ditellurides and their alloys, have also shown promise for applications in phase-change memory applications.

The ASIN group has developed robust processes for the vapour-phase growth of many members of the TMD family. Recently, low-temperature approaches have been established for the growth of less-studied TMDs such as $PtSe_2$, $MoTe_2$, WTe_2 and $PtTe_2$. Within this project the resistive switching behaviour of TMDs grown by low-temperature approaches will be explored. Key components of this project will include (1) Low-temperature, vapour-phase growth of 2D materials; (2) Electrical characterisation of 2D materials, including an examination of the switching behaviour in certain systems; (3) Scanning probe characterisation of 2D materials including conductive atomic force microscopy (c-AFM) and Kelvin probe force microscopy (KPFM); (4) Rigorous characterisation of materials grown by spectroscopy and electron microscopy.

Guideline deliverables for years 1 and 2 of the project are outlined below

Year 1: Explore 2D candidates with potential for low-temperature, vapour-phase growth (typically < 500 ^{o}C) on insulating substrates (promising results already obtained for $PtSe_2$). Examine switching behaviour locally (c-AFM) and over a micrometre scale (with cross bar contacting) for mono- and/or few-layer 2D systems.

Year 2: Examine the nature of the switching behaviour in selected 2D systems along with mechanisms leading to modification of the high and low resistance states. Investigate the role of TMD crystal size on switching behaviour and endurance.

Selection criteria

A skilled, motivated and enthusiastic candidate is sought for this PhD project. The ideal applicants will have a 1^{st} Class Honours Bachelor's degree in Materials Science, Chemistry, Physics or a related discipline. Applications will be considered from EU candidates only due to limitations on the funding available for fees. The project will primarily be conducted in the ASIN group labs in AMBER (Advanced Materials and BioEngineering Research Institute) and the studies will be undertaken through the School of Chemistry, Trinity College Dublin. While the project is associated with the School of Chemistry, it is interdisciplinary in nature and some background in any of Physics, Materials Science and Engineering, in addition to Chemistry, would be beneficial. The project will be mostly experimental in nature so previous lab experience is desirable. The ability to work both independently and as part of a multidisciplinary project team in addition to excellent oral and written communication skills will also be required for the successful realisation of the project.

How to apply:

CVs with the names and addresses of three referees should be submitted to:

Dr. Niall McEvoy (nmcevoy@tcd.ie)

Positions will remain opened until filled but preferred start date is September 2 2019. Only short-listed applications will be acknowledged.

This position is funded by the SFI-research centre AMBER.

The AMBER research centre, as a community of researchers, welcomes its responsibility to provide equal opportunities for all. We are actively seeking diversity in our research teams and particularly encourage applications from underrepresented groups.